

Big Data Analytics: Distinguishing Features of Older Drivers with Stable Cognitive and Physical Health



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Introduction

Long term longitudinal driving studies are now possible with available sensor and storage technology. Identification of the driver of the vehicle has emerged as a challenge for these studies. Big data analysis all driving by 14 older drivers to identify features and methods to allow drivers to be distinguished.

| | |
|-----------------------|---|
| Demographic Data | Total 14: Male 9, Female 5 Age at entry: mean 75.7, st dev 5.4 |
| Trips / yr | mean 1567, st dev 647 |
| Distance / yr | mean 20,200km, st dev 10,600km |
| Average Trip Duration | mean 15.0min, st dev 3.1min |
| Average Trip Distance | mean 13.6km, st dev 7.0km |

Method

Big data analytics

Trip Feature extraction

- Trip duration (time and distance)
- Time of Day (time, solar cycle, rush hour)
- Velocity (actual velocity, relative to posted limit)
- Acceleration, Jerk (min, max, histogram)

Driver behaviours - Acceleration/Deceleration events

- Continuous acceleration/deceleration with a total velocity change of >4km/hr

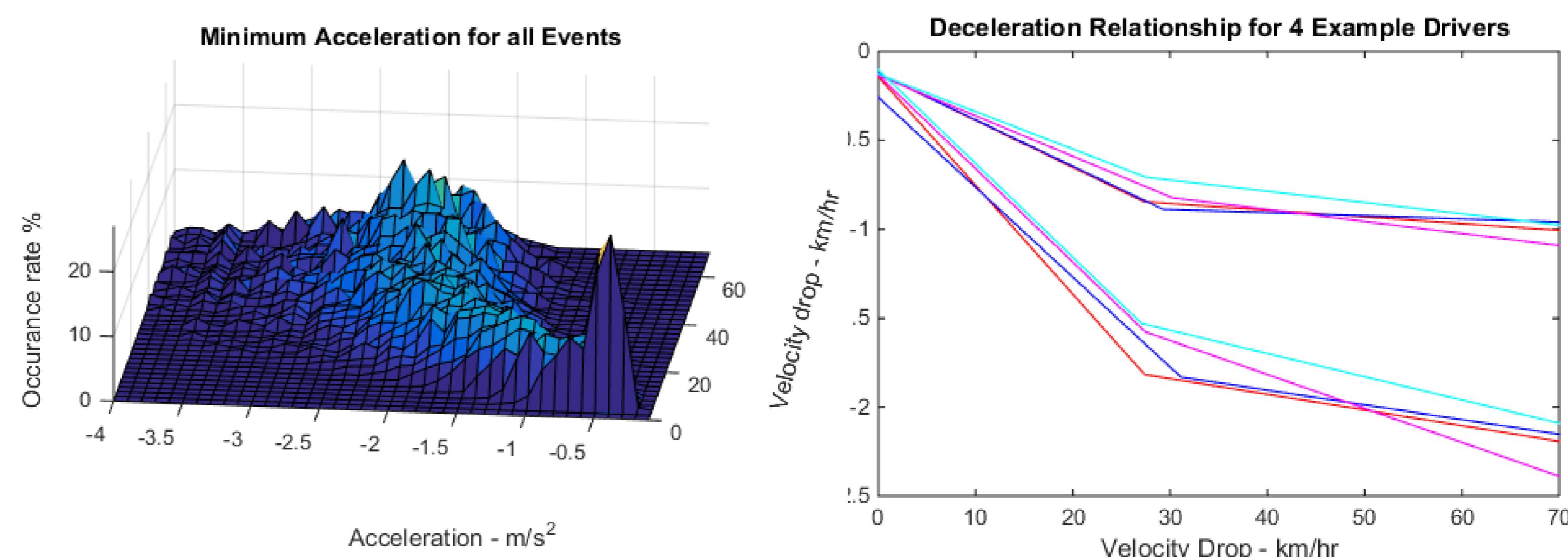
Classification

Linear Discriminant Analysis (LDA)

- Adaptive modeling using only features to achieve best result
- Train on 90%, test on 10% model for 10 cases
- 14 drivers allow 91 two driver pairs to be formed.

| | |
|--|--|
| Acceleration/Deceleration Event Attributes | Mean Acceleration Minimum/Maximum Acceleration Actual acceleration values |
| Velocity Attributes | Velocity change Initial/Final velocity for event Actual velocity values |
| Duration Attributes | Duration of event |
| Time Attributes | Time of Day Date of event Solar cycle position Traffic level (Rush hour or not) |
| Road Network | Posted speed limit |

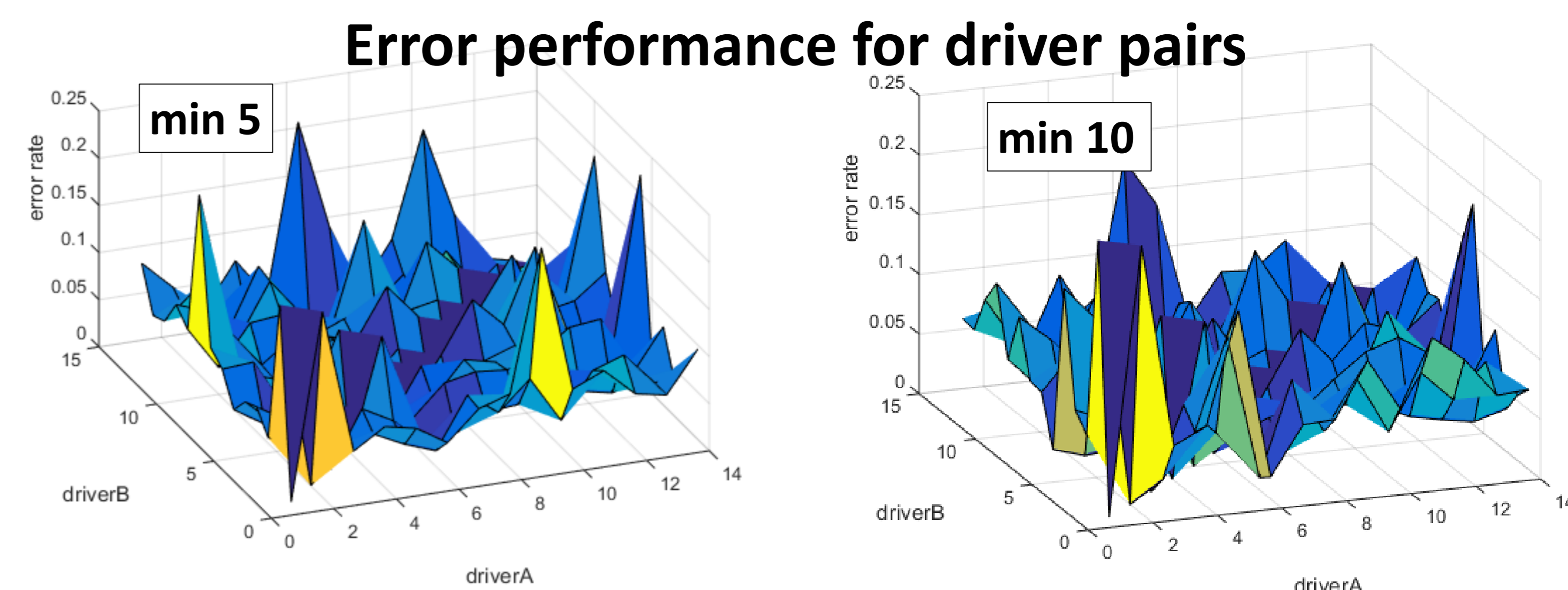
Results



Example Deceleration two phase profiles

| Driver | Deceleration | | Acceleration | |
|--------|--------------|--------|--------------|--------|
| | Year 1 | Year 2 | Year 1 | Year 2 |
| mean | 30156 | 33502 | 30600 | 34263 |
| st dev | 11010 | 15357 | 10840 | 15576 |

Acceleration and Deceleration event statistics for 14 drivers



| Classifier Error Rate | Trips with >= 5 events | Trips with >= 10 events |
|-----------------------|------------------------|-------------------------|
| Best | 1.3% | 0.9% |
| Worst | 22.9% | 22.5% |
| Mean | 6.2% | 6.1% |
| st dev | 4.1% | 3.9% |

LDA Classifier performance for 91 driver pairs depending on the number of deceleration/acceleration events in trip

Discussion and Conclusions

This work shows the potential for a driver signature to be created to allow for drivers of a shared vehicle to be distinguished from each other based on their differing driving behaviours.

The work also has potential application in automated driving systems to allow for personalization of the self driving car behaviour.

Results show that on average 6.1% of the trips are classified incorrectly.

Funding and Partnerships

Contact Information

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